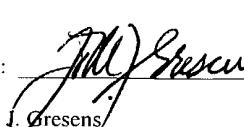


U. S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE		ATTORNEY'S DOCKET NUMBER
FORM PTO-1390 (REV 10-94)		12845.5USWO
TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371		U.S. APPLICATION NO. (If known, see 37 CFR 1.5) Unknown 10/088243
INTERNATIONAL APPLICATION NO. PCT/DK00/00515	INTERNATIONAL FILING DATE 15 September 2000	PRIORITY DATE CLAIMED 15 September 1999
TITLE OF INVENTION LASER APPARATUS		
APPLICANT(S) FOR DO/EO/US RONVIG et al.		
Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:		
<ol style="list-style-type: none"> 1. <input checked="" type="checkbox"/> This is a FIRST submission of items concerning a filing under 35 U.S.C. 371. 2. <input type="checkbox"/> This is a SECOND or SUBSEQUENT submission of items concerning a filing under 35 U.S.C. 371. 3. <input checked="" type="checkbox"/> This express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(l). 4. <input checked="" type="checkbox"/> A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date. 5. <input checked="" type="checkbox"/> A copy of the International Application as filed (35 U.S.C. 371(c)(2)) <ol style="list-style-type: none"> a. <input checked="" type="checkbox"/> is transmitted herewith (required only if not transmitted by the International Bureau). b. <input checked="" type="checkbox"/> has been transmitted by the International Bureau. c. <input type="checkbox"/> is not required, as the application was filed in the United States Receiving Office (RO/US) 6. <input type="checkbox"/> A translation of the International Application into English (35 U.S.C. 371(c)(2)). 7. <input checked="" type="checkbox"/> Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3)) <ol style="list-style-type: none"> a. <input type="checkbox"/> are transmitted herewith (required only if not transmitted by the International Bureau). b. <input type="checkbox"/> have been transmitted by the International Bureau. c. <input type="checkbox"/> have not been made; however, the time limit for making such amendments has NOT expired. d. <input checked="" type="checkbox"/> have not been made and will not be made. 8. <input type="checkbox"/> A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)). 9. <input checked="" type="checkbox"/> An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)). 10. <input type="checkbox"/> A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)). 		
Items 11. to 16. below concern document(s) or information included:		
<ol style="list-style-type: none"> 11. <input type="checkbox"/> An Information Disclosure Statement under 37 CFR 1.97 and 1.98. 12. <input type="checkbox"/> An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included. 13. <input checked="" type="checkbox"/> A FIRST preliminary amendment. <input type="checkbox"/> A SECOND or SUBSEQUENT preliminary amendment. 14. <input type="checkbox"/> A substitute specification. 15. <input type="checkbox"/> A change of power of attorney and/or address letter. 16. <input checked="" type="checkbox"/> Other items or information: Application Data Sheet 		

U.S. APPLICATION NO (If known, see 37 CFR 1.5) Unknown 10108824		INTERNATIONAL APPLICATION NO PCT/DK00/00515	ATTORNEY'S DOCKET NUMBER 12845.5USWO
17. [X] The following fees are submitted:		CALCULATIONS PTO USE ONLY	
BASIC NATIONAL FEE (37 CFR 1.492(a) (1)-(5)): Search Report has been prepared by the EPO or JPO..... \$890.00			
International preliminary examination fee paid to USPTO (37 CFR 1.492(a)(1))..... \$710.00			
No international preliminary examination fee paid to USPTO (37 CFR 1.482) but international search fee paid to USPTO (37 CFR 1.445(a)(2))..... \$740.00			
Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(3)) paid to USPTO \$1040.00			
International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(2)-(4) \$100.00			
ENTER APPROPRIATE BASIC FEE AMOUNT =		\$890.00	
Surcharge of \$130.00 for furnishing the oath or declaration later than [] 20 [] 30 months from the earliest claimed priority date (37 CFR 1.492(e)).		\$	
CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE
Total claims	20	-20 =	X \$18.00
Independent claims	1	-3 =	X \$80.00
MULTIPLE DEPENDENT CLAIM(S) (if applicable)		+ \$260.00	\$
TOTAL OF ABOVE CALCULATIONS =		\$890.00	
Reduction by 1/2 for filing by small entity, if applicable. Small entity status is claimed pursuant to 37 CFR 1.27		\$	
SUBTOTAL =		\$890.00	
Processing fee of \$130.00 for furnishing the English translation later than [] 20 [] 30 months from the earliest claimed priority date (37 CFR 1.492(f)).		+ \$	
TOTAL NATIONAL FEE =		\$890.00	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). \$40.00 per property		+ \$	
TOTAL FEES ENCLOSED =		\$890.00	
		Amount to be: refunded	\$
		charged	\$
<p>a. [X] Check(s) in the amount of <u>\$890.00</u> to cover the above fees is enclosed.</p> <p>b. [] Please charge my Deposit Account No. _____ in the amount of \$ _____ to cover the above fees. A duplicate copy of this sheet is enclosed.</p> <p>c. [X] The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. <u>13-2725</u>.</p>			
<p>NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.</p>			
SEND ALL CORRESPONDENCE TO John J. Gresens MERCHANT & GOULD P.O. Box 2903 Minneapolis, MN 55402-0903		SIGNATURE:  NAME: John J. Gresens REGISTRATION NUMBER: 33,112	

S/N unknown

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	RONVIG et al.	Docket No.:	12845.5USWO
Serial No.:	unknown	Filed:	concurrent herewith
Int'l Appln No.:	PCT/DK00/00515	Int'l Filing Date:	15 September 2000
Title:	LASER APPARATUS		

CERTIFICATE UNDER 37 CFR 1.10

'Express Mail' mailing label number: EV037638860US

Date of Deposit: 15 March 2002

I hereby certify that this correspondence is being deposited with the United States Postal Service 'Express Mail Post Office To Addressee' service under 37 CFR 1.10 on the date indicated above and is addressed to the Assistant Commissioner for Patents, Washington, D.C. 20231.

By: 
Name: Chris Stordahl

PRELIMINARY AMENDMENT

Box PCT
Assistant Commissioner for Patents
Washington, D. C. 20231

Dear Sir:

In connection with the above-identified application filed herewith, please enter the following preliminary amendment, which is based on claims amended in prosecution of the international application and published in the International Preliminary Examination Report, a copy of which is enclosed herewith:

IN THE ABSTRACT

Insert the attached Abstract page into the application as the last page thereof.

IN THE SPECIFICATION

A courtesy copy of the originally-filed PCT specification is enclosed herewith, but the World Intellectual Property Office (WIPO) copy should be relied upon if it is already in the U.S. Patent Office.

Please add the following to page 1, line 29 of the specification.

GB 2 144 561 (D1) discloses a laser system for treatment to for example the eye, wherein the laser system is particularly suitable for laser surgery, i.e. cutting by means of the laser. The laser system comprises an energy measure system used for monitoring the treatment beam for calibrations prior to treatment as well as continuously during treatment. The reference does not discuss any risks for reflections from the treated eye.

EP 786 837 (D2) discloses an integrated laser-light source, which generate laser light having a controlled intensity. The laser is a surface-emitting laser as opposed to edge-emitting laser, and therefore the arrangement of the intensity control of the laser has to be arranged differently than for edge-emitting laser, the latter being depicted in Figure 1 of the reference D2. D2 does not discuss precautions to be taken to avoid reflections from a surface to which the laser light is emitted to be reflected to an intensity control sensor. Furthermore, several of the arrangements shown in D2 does in fact present the problem, which is seen in Figures 4A, 4C, 4D, 6A and 7 wherein any reflections from the surface being reflected in any angle different from 90 degrees to the housing of the laser would have a risk of being reflected to the intensity control sensor, which would lead to a reduction of the intensity of the laser light.

IN THE CLAIMS

Please amend the following claims as indicated below. A marked-up copy of all claims is attached for reference.

3. (amended) The apparatus according to claim 1, wherein the laser light emitting optical system comprises a diaphragm (4, 104) with an aperture located between the laser light emitter and the collimating lens (3, 103) in the beam path.

4. (amended) The apparatus according to claim 1, wherein the power stabilizing system comprises absorbing means (7, 107) for absorbing light emitted from the laser light emitting system.

6. (amended) The apparatus according to claim 1, wherein the deflection system comprises a transmission/reflection mirror (8) provided obliquely to the optical axis.

8. (amended) The apparatus according to claim 6, wherein at most 5% of the light is reflected, preferably at most 2% is reflected.

9. (amended) The apparatus according to claim 1, wherein the deflection system comprises an optical isolator (108).

11. (amended) The apparatus according to claim 1, further comprising a guide light (14, 114) emitting optical system for emitting light to the surface to be treated.

13. (amended) The apparatus according to claim 11, wherein the transmission/reflection mirror (8) or the optical isolator (108) is arranged for directing the guide light.

14. (amended) The apparatus according to claim 1, wherein the power stabilizing system and the deflection system (8, 108) is arranged adjacent in a housing (6, 106).

20. (amended) Use of a laser apparatus as defined in claim 1 for reducing the risk that
reflections reflected from a surface, whereto laser light is emitted, are capable of reaching a
stabilizing system of the laser light emitting system.

REMARKS

The above preliminary amendment is made to remove multiple dependencies from claims 3, 4, 6, 8, 9, 11, 13, 14, 17 and 20 and to add new matter to the specification.

A new abstract page is supplied to conform to that appearing on the publication page of the WIPO application, but the new Abstract is typed on a separate page as required by U.S. practice.

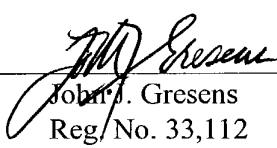
Applicant respectfully requests that the preliminary amendment described herein be entered into the record prior to calculation of the filing fee and prior to examination and consideration of the above-identified application.

If a telephone conference would be helpful in resolving any issues concerning this communication, please contact Applicant's primary attorney-of record, John J. Gresens (Reg. No. 33,112), at (612) 371.5265.

Respectfully submitted,

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Dated: 15 March 2002

By 
John J. Gresens
Reg. No. 33,112

IIG/kjr

12845.5USWO

ABSTRACT

The present invention relates to a laser apparatus comprising a laser light emitting optical system for emitting laser light to a surface, a power stabilizing system for stabilizing the laser light power with a predetermined power interval, and a deflection system for deflecting light reflected from the surface away from the power stabilizing system. Thereby, the power stabilizing system will not erroneously regulate the power due to reflections from the surface to be treated. Furthermore, the invention relates to a method for treating an animal, including a human being, for a laser light treatable disease using the laser apparatus on the skin or the mucosa of the animal and allowing laser light to be emitted from the laser light emitting optical system to the skin or mucosa.

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MARKED UP COPY OF CLAIMS

3. The apparatus according to [any of the preceding]claim[s] 1, wherein the laser light emitting optical system comprises a diaphragm (4, 104) with an aperture located between the laser light emitter and the collimating lens (3, 103) in the beam path.
4. The apparatus according to [any of the preceding]claim[s] 1, wherein the power stabilizing system comprises absorbing means (7, 107) for absorbing light emitted from the laser light emitting system.
6. The apparatus according to [any of the preceding]claim[s] 1, wherein the deflection system comprises a transmission/reflection mirror (8) provided obliquely to the optical axis.
8. The apparatus according to claim 6[or 7], wherein at most 5% of the light is reflected, preferably at most 2% is reflected.
9. The apparatus according to [any of the preceding]claim[s] 1-5, wherein the deflection system comprises an optical isolator (108).
11. The apparatus according to [any of the preceding]claim[s] 1, further comprising a guide light (14, 114) emitting optical system for emitting light to the surface to be treated.
13. The apparatus according to claim 11[or 12], wherein the transmission/reflection mirror (8) or the optical isolator (108) is arranged for directing the guide light.
14. The apparatus according to [any of the preceding]claim[s] 1, wherein the power stabilizing system and the deflection system (8, 108) is arranged adjacent in a housing (6, 106).
17. A method for treating an animal, including a human being, for a laser light treatable disease comprising arranging a laser apparatus as defined in [any of the]claim[s] 1[-16] in

contact with the skin or the mucosa of the animal and allowing laser light to be emitted from the laser light emitting optical system to the skin or mucosa.

20. Use of a laser apparatus as defined in [any of the]claim 1[-16] for reducing the risk that reflections reflected from a surface, whereto laser light is emitted, are capable of reaching a stabilizing system of the laser light emitting system.

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Amended claims 23 October 2001:

1. A laser apparatus (1, 101) for use in treatment of skin or mucosa of an animal, including a human being, comprising
 - 5 a laser light emitting optical system for emitting laser light to a surface, said surface being skin or mucosa, the laser light emitting system comprising a laser diode (2, 102) emitting a laser beam and a collimating lens (3, 103), said collimating lens (3, 103) being arranged in the laser light beam path,
 - 10 a power stabilising system for stabilising the laser light power within a predetermined power interval,
 - 15 a light wave guide cable (10, 110) arranged in the laser light beam path for directing laser light to the surface, and a deflection system (8, 108) for deflecting light reflected from the surface away from the power stabilising system.
- 20 2. The apparatus according to claim 1, wherein the laser light emitting optical system comprises a laser diode (2, 102) emitting light within 600 – 1000 nm.
3. The apparatus according to any of the preceding claims, wherein the laser light emitting optical system comprises a diaphragm (4, 104) with an aperture located
 - 25 between the laser light emitter and the collimating lens (3, 103) in the beam path.
4. The apparatus according to any of the preceding claims, wherein the power stabilising system comprises absorbing means (7, 107) for absorbing light emitted
 - 30 from the laser light emitting system.
5. The apparatus according to claim 4, wherein the absorbing means (7, 107) is a photo diode, preferably a silicon photo diode.

6. The apparatus according to any of the preceding claims, wherein the deflection system comprises a transmission/reflection mirror (8) provided obliquely to the optical axis.
- 5 7. The apparatus according to claim 6, wherein at least 90 % of the light emitted is transmitted through the mirror (8).
8. The apparatus according to claim 6 or 7, wherein at most 5 % of the light is reflected, preferably at most 2 % is reflected.
- 10 9. The apparatus according to any of the preceding claims 1-5, wherein the deflection system comprises an optical isolator (108).
- 15 10. The apparatus according to claim 9, wherein the optical isolator (108) is a couple prism system with phase retarder.
11. The apparatus according to any of the preceding claims, further comprising a guide light (14, 114) emitting optical system for emitting light to the surface to be treated.
- 20 12. The apparatus according to claim 11, wherein the wave length of the guide light is lower than the wave length of the laser light emitting system.
- 25 13. The apparatus according to claim 11 or 12, wherein the transmission/reflection mirror (8) or the optical isolator (108) is arranged for directing the guide light.
14. The apparatus according to any of the preceding claims, wherein the power stabilising system and the deflection system (8, 108) is arranged adjacent in a housing (6, 106).
- 30 15. The apparatus according to claim 14, wherein the housing (6, 106) further comprises a guide light emitting optical system.
16. The apparatus according to claim 1, wherein the light wave guide cable is a quartz glass rod.

17. A method for treating an animal, including a human being, for a laser light treat-
able disease comprising arranging a laser apparatus as defined in any of the
claims 1-16 in contact with the skin or the mucosa of the animal and allowing la-
ser light to be emitted from the laser light emitting optical system to the skin or
mucosa.

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18. The method according to claim 17, for treating muscle damages.

10 19. The method according to claim 17, for treating ulcers.

20. Use of a laser apparatus as defined in any of the claim 1-16 for reducing the risk
that reflections reflected from a surface, whereof laser light is emitted, are capa-
ble of reaching a stabilising system of the laser light emitting system.

Laser apparatus

The present invention relates to a laser apparatus for emitting laser light to a surface, said surface in particular being the skin or the mucosa of a person.

5

Background

Medical laser treatment has been used for several years for various treatments, such as laser surgery, treatment of skin and ulcers or underlying tissue. The effect 10 of the laser therapy is related to the wavelength and the power of the laser light, and it is important that the power of the laser light is controlled within a predetermined range. Also, it is necessary that the power of the laser light emitted does not exceed a certain limit in order to avoid any damages of the treated person.

15 Therefore, many medical laser apparatuses have been provided with a power stabilising system for stabilising the laser light power within a predetermined range.

Prior art laser apparatus for treatment of the skin of a person is usually equipped 20 with a photo diode located in the light emitting diode for absorption of a reflected part of the emitted light during use. Thereby the laser light power is controlled within predetermined limits. However it has been found that some light may be reflected from the skin also, leading to an erroneously high amount of laser energy absorbed 25 by the photo diode because light reflected from the surface to be treated will be absorbed by the photo diode in addition to the light from laser chip. Thereby, the controlling mechanism of the laser apparatus will regulate the light emission to a too low power level. This has in many instances led to a sub-optimal treatment or treatment without any effect, because the laser has almost been shot off during use.

30 GB 2 144 561 (D1) discloses a laser system for treatment to for example the eye, wherein the laser system is particularly suitable for laser surgery, i.e. cutting by means of the laser. The laser system comprises an energy measure system used for monitoring the treatment beam for calibrations prior to treatment as well as continuously during treatment. The reference does not discuss any risks for reflections from the treated eye.

P 364 PC00

1a

EP 786 837 (D2) discloses an integrated laser-light source, which generate laser light having a controlled Intensity. The laser is a surface-emitting laser as opposed to edge-emitting laser, and therefore the arrangement of the intensity control of the 5 laser has to be arranged differently than for edge-emitting laser, the latter being depicted in Figure 1 of the reference D2. D2 does not discuss precautions to be taken to avoid reflections from a surface to which the laser light is emitted to be reflected to an intensity control sensor. Furthermore, several of the arrangements shown in 10 D2, does in fact present the problem, which is seen in Figures 4A, 4C, 4D, 6A, and 7 wherein any reflections from the surface being reflected in any angle different from 90 degrees to the housing of the laser would have a risk of being reflected to the intensity control sensor, which would lead to a reduction of the intensity of the laser light.

15 **Summary of the Invention**

Accordingly, it has been an object of the invention to provide an apparatus having a stabilising system which is not compromised by light reflected by the surface to be treated, and which provides at least the same level of security against damages.

20

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Tårup (DK).For two-letter codes and other abbreviations, refer to the "Guid-
ance Notes on Codes and Abbreviations" appearing at the begin-
ning of each regular issue of the PCT Gazette.(74) Agent: HØIBERG APS; Nørre Farimsgade 37,
DK-1364 Copenhagen K (DK).

WO 01/19454 A2

(54) Title: LASER APPARATUS

(57) Abstract: The present relation relates to a laser apparatus comprising a laser light emitting optical system for emitting laser light to a surface, a power stabilising system for stabilising the laser light power within a predetermined power interval, and a deflection system for deflecting light reflected from the surface away from the power stabilising system. Thereby, the power stabilizing system will not erroneously regulate the power due to reflections from the surface to be treated. Furthermore, the invention relates to a method for treating an animal, including a human being, for a laser light treatable disease using the laser apparatus on the skin or the mucosa of the animal and allowing laser light to be emitted from the laser light emitting optical system to the skin or mucosa.

Laser apparatus

The present invention relates to a laser apparatus for emitting laser light to a surface, said surface in particular being the skin or the mucosa of a person.

5

Background

Medical laser treatment has been used for several years for various treatments, such as laser surgery, treatment of skin and ulcers or underlying tissue. The effect 10 of the laser therapy is related to the wavelength and the power of the laser light, and it is important that the power of the laser light is controlled within a predetermined range. Also, it is necessary that the power of the laser light emitted does not exceed a certain limit in order to avoid any damages of the treated person.

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Therefore, many medical laser apparatuses have been provided with a power stabilising system for stabilising the laser light power within a predetermined range.

20

Prior art laser apparatus for treatment of the skin of a person is usually equipped with a photo diode located in the light emitting diode for absorption of a reflected part of the emitted light during use. Thereby the laser light power is controlled within predetermined limits. However it has been found that some light may be reflected 25 from the skin also, leading to an erroneously high amount of laser energy absorbed by the photo diode because light reflected from the surface to be treated will be absorbed by the photo diode in addition to the light from laser chip. Thereby, the controlling mechanism of the laser apparatus will regulate the light emission to a too low power level. This has in many instances led to a sub-optimal treatment or treatment without any effect, because the laser has almost been shot off during use.

Summary of the invention

30

Accordingly, it has been an object of the invention to provide an apparatus having a stabilising system which is not compromised by light reflected by the surface to be treated, and which provides at least the same level of security against damages.

Thus, the invention relates to a laser apparatus comprising a laser light emitting optical system for emitting laser light to a surface, and a power stabilising system for stabilising the laser light power within a predetermined power interval comprising power stabilising means, wherein a deflection system is provided in the beam path 5 for deflecting light reflected from the surface away from the power stabilising means.

Thereby, the power stabilising system is not disturbed by light reflected from the surface.

10 Another object of the invention is the use of the laser apparatus as defined above for medical treatment.

Drawings

15 Fig. 1 is showing a schematic view of the laser apparatus according to the invention.

Fig. 2 is showing the laser apparatus of Fig. 1 when assembled.

20 Fig. 3 is showing the laser apparatus of Fig. 1 further comprising a guide light

Fig. 4 is showing a schematic view of another embodiment of the laser apparatus according to the invention comprising an optical isolator.

25 Fig. 5 is showing the laser apparatus of Fig. 4 when assembled

Fig. 6 shows a laser diode package in detail.

Detailed description of the invention

30 The laser apparatus according to the invention may be any apparatus for emitting laser light onto a surface, in particular any laser apparatus for medical, dental or the like treatments, wherein the laser light is emitted to intact skin or mucosa of an animal, including a human being. By these apparatuses a risk of reflection of the laser light from the skin exists. The apparatus is preferably a handheld apparatus by 35 which the treatment is carried out by moving the apparatus over the skin or mucosa.

For medical and dental treatment the laser light is preferably light within 600 – 1000 nm. The wave length preferred depends primarily on the type of disorder to be treated. For healing wounds the light is preferably about 660-670 nm, whereas light about 904 nm is preferred for bone healing. For other disorders light of about 820-830 nm or about 980 nm is chosen.

As mentioned above, it is important that the power of the laser light is adjusted within a predetermined range in order to avoid damage of the surface and/or underlying tissues to be treated. Therefore, the present apparatus includes a power stabilising system for stabilising the laser light power within a predetermined power interval, said stabilising system being a system wherein the laser light emitted is measured and a signal representing the power of the laser light is transmitted to the laser diode, whereby the power of the laser diode may be adjusted or regulated into the predetermined range or interval.

The surface may be any surface as described above, and will mostly be the skin or the mucosa of a human being. Depending on various conditions, such as age and health of the person, the skin will be more or less reflecting, the reflection also being dependant on the angle of the laser apparatus held in relation to the surface, therefore it is an object of the present invention that light reflected from the surface does not interfere with the stabilising system, and accordingly, the apparatus according to the invention includes a deflection system for deflecting light reflected from the surface away from the power stabilising means.

Laser light is emitted from a laser diode in the laser light emitting system. The laser light is preferably directed into a predetermined laser beam path by the use of at least one light beam collecting lens. The collecting lens is preferably a collimating lens. Also in order to direct the laser light the laser light emitting optical system may comprise a diaphragm with an aperture, whereby the laser light from the laser diode passes through the aperture to be collected by the collimating lens into the predetermined beam path.

In the present context, by the term "power stabilising means" is meant a system for measuring the power of the light emitted and then by means of a regulating means

the power of the laser diode is either decreased, increased or not adjusted in response to a signal representing the power measured by the stabilising system.

5 The power stabilising system preferably comprises absorbing means for absorbing light emitted from the laser light emitting system whereby a signal representing the power of the light absorbed is transmitted to the laser diode for adjusting the power of the laser diode into the predetermined power range, if necessary. In a preferred embodiment the absorbing means is a photo diode arranged to absorb a part of the laser light emitted before the laser light is transmitted to the surface. The photo diode may be any suitable photo diode, such as a silicon photo diode.

10 In a preferred embodiment of the invention the deflection system comprises a transmission/reflection mirror provided obliquely to the axis of the laser beam. By use of the transmission/reflection mirror a major part of the laser light is transmitted through the mirror and to the surface to be treated whereas a minor part of the laser light is reflected. The absorbing means of the stabilising system is then arranged in order to be able to absorb the light reflected from the mirror. Due to the oblique arrangement of the mirror and the consequent arrangement of the absorbing means it is secured that any light reflected from the surface to be treated will not enter the path of the light reflected from the mirror, and the stabilising system will not be disturbed by erroneously reflected light. The angle of the obliquely arranged mirror to the axis of the laser beam may be any suitable angle, however normally an angle of about 45 ° is preferred, such as between 40 ° and 50 °.

15 20 25 It is preferred that only a minor part of the laser light is reflected by the mirror, leading to a major part being able to be transmitted through the mirror. Preferably, at least 90 % of the light emitted is transmitted through the mirror, more preferably at least 95 % of the light emitted is transmitted through the mirror.

30 Thereby, it is preferred that at most 5 % of the light is reflected, preferably at most 2 % is reflected by the mirror.

Furthermore, the mirror is preferably only transmitting laser light within a narrow wave length interval, leading to reflection of all the light having other wave lengths.

In another preferred embodiment the deflection system comprises an optical isolator. When using an optical isolator the absorbing means may be arranged anywhere in the beam of the laser diode, even adjacent the laser diode or behind the laser diode, since light reflected from the surface to be treated will not pass the optical isolator back to the absorbing means. Any suitable optical isolator may be used, such as a cubus or a double prism system with phase retarder acting as a reflex inhibitor by rotating the polarised laser light. The prism system preferably rotates the laser light 45 ° by each passing, whereby light reflected from the surface passing the prism system will be rotated 2 x 45 ° and therefore not enter a path leading to the absorbing means. By placing the absorbing means in the beam path of the laser diode, the absorbing means may measure the laser light directly.

In this embodiment the absorbing means are preferably arranged adjacent the laser diode, and activated by a minor part of the laser light emitted to the absorbing means, however light reflected from the surface does not enter the same beam path and the risk of interference of the stabilising system is avoided.

The laser light may be visible red light or invisible infra red light. In case of the latter it is preferred when using the laser apparatus for medical or dental treatment that a guide light is used for indication of the position of invisible laser beam. Accordingly, in one embodiment the apparatus according to the invention preferably further comprises a guide light emitting optical system for emitting visible light to the surface to be treated.

25 In the preferred embodiment in order to minimise the number of components of the laser apparatus, the guide light is directed into the light beam of the laser light by means of the transmission/reflection mirror or the optical isolator of the deflection system.

30 When using the transmission/reflection mirror as a direction means for the guide light, it is preferred, that the wave length of the guide light is lower than the wave length of the laser light emitting system. Thereby it is ensured, that the guide light will not be transmitted through the transmission/reflection mirror and further onto the absorbing means. The guide light diode is preferably arranged in parallel with the laser light diode, and the guide light is directed into the laser light beam by means of

reflection by a guide light reflection mirror onto the transmission/reflection mirror and then further reflected into the laser light beam. In this embodiment the angle of the obliquely arranged transmission/reflection mirror is preferably 45° with respect to the axis of the laser light beam.

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The laser apparatus according to the invention is preferably arranged in a main housing, wherein the power stabilising system and the deflection system are arranged adjacent in the housing. The main housing may be constructed to receive the laser light optical system as a separateable sub-unit of the housing. Furthermore, the main housing may comprise the guide light emitting optical system as discussed above. The laser light optical system may itself be housed in a diode housing, as an independent unit of the apparatus.

10 The main housing is preferably an elongate housing, in one end receiving the diode housing, and in the opposite end being adapted for receiving a light wave guide cable.

15 The light wave guide cable may be straight or curved as is suitable for the treatment to be carried out. A straight light wave guide cable may be a quartz glass rod, such as a PT2 from Schott. As a curved cable any suitable optical fibre may be used. However, for most medical and dental treatments the straight cable is preferred. The cable may be arranged in a housing, the cable housing, adapted to be mounted to the main housing before using the laser apparatus.

20 25 Any suitable power source may be applied, such as through a transformer from the mains or through a battery, preferably a rechargeable battery.

30 The apparatus is preferably provided with a switch itself, in addition to other power-switches. Thereby the person holding the laser apparatus is able to switch off the apparatus, if necessary during treatment.

Another object of the invention is a method for treating an animal, including a human being, for a laser light treatable disease comprising arranging a laser apparatus as defined above in contact with the skin or the mucosa of the animal and allowing la-

ser light to be emitted from the laser light emitting optical system to the skin or mucosa.

5 The laser apparatus is brought in contact with the skin or mucosa for a period necessary for the treatment. The laser apparatus may be held at the same position on the skin or mucosa or may be moved over the skin or mucosa, optionally by slow movements, to effect the tissue to be treated from different angles.

10 The method may be applied for any disorder or disease wherein laser treatment is indicated, such as for treating muscle damages or for treating ulcers.

The invention is further described in relation to the drawings which are to be considered as examples of the invention only, and not as limitations of the invention.

15 In Fig. 1 the laser apparatus 1 is shown in parts in a schematic view. The main housing 6 of the laser apparatus 1 is adapted for receiving the diode housing 5. A laser diode 2 emitting light is arranged in the diode housing 5 so that the power supply for the diode 2 may be received in one end of the housing, said end being in the rear end of the main housing 6 when the laser apparatus 1 is assembled. The diode housing 5 further comprises a collimating lens 3 arranged in front of the diode 2, in the beam path of the laser beam from the laser diode 2. Between the laser diode 2 and the collimating lens 3 a diaphragm with an aperture 4 is located.

25 The main housing 6 is arranged with two opposing end, wherein one end is adapted for receiving the diode housing 5 and the other end is adapted for receiving a cable housing 9. The main housing comprises a mirror 8 for reflecting a part of the laser beam to a photo diode 7 as a part of the power stabilising system of the laser apparatus 1. The mirror 8 is arranged obliquely, approx. in an angle of 45° with respect to the laser beam. The mirror 8 allows approx. 99% of the laser beam to pass and only 1% of the laser beam is reflected to the photo diode 7. The photo diode 7 is located in order to receive the reflected laser light. From the photo diode 7 a signal relating to the amount of light received is forwarded to the laser diode 2 by means of a automatic power control (APC) (not shown) and the power of the laser diode 2 may be increased or decreased as a response to the signal received.

The cable housing 9 comprises a light wave guide cable for transmitting the laser light to the surface to be treated.

5 In Fig. 2 the laser apparatus of Fig. 1 is shown assembled and the laser diode 2 is emitting laser light, exemplified by the laser beam 11. The part of the laser beam reflected by the mirror 8 is exemplified by the beam path 12 to the photo diode 7. The rest of the laser beam 11 is passing through the mirror 8 to the light wave guide cable 10 in order to reach the surface to be treated.

10 When the laser beam reaches the surface to be treated any light reflected from the surface may be transmitted back and is either reflected by or transmitted through the mirror 8 and even to the laser diode 2, however due to the arrangement of the mirror 8 and the photo diode 7 the reflected light will not reach the photo diode 7, whereby no disturbance of the stabilising system of the laser diode 2 is seen.

15 20 25 In Fig. 3 a laser apparatus 1 as shown in Fig. 1 is depicted further comprising a guide light optical system. The guide light optical system comprises a guide light diode 14 and a mirror 13 for directing the guide light onto the mirror 8 whereby the guide light is reflected further in order to be directed into the beam path 11 of the laser light. The wave length of the guide light is chosen to be different from the wave length of the laser light itself and hereby the guide light is reflected by and or transmitted through the mirror, in order to be able to avoid that the guide light passes the mirror 8 onto the photo diode 7, which would lead to an erroneous signal forwarded to the laser diode 2. In this case the mirror 8 is a transmission/reflecting mirror with respect to the laser light and a totally reflecting mirror with respect to the guide light.

30 In Fig. 4 another embodiment of the present Invention is shown. The cable housing 109 is as described above for the cable housing 9, whereas the main housing 106 comprises a double prism system with phase retarder 108 as part of the deflection system. In the embodiment depicted the main housing 106 is further comprising a guide light diode 114 arranged parallel to the laser diode 102, when the laser apparatus 101 is assembled. When using a prism system 108 as a deflecting means, the position of the absorbing means 107 is not crucial anymore, and in the embodiment depicted in Fig. 4 the photo diode 107 is arranged adjacent the laser diode 102 in

the diode housing 105. The diode housing 105 further comprises the components as described above for the diode housing 5.

As may be seen in Fig. 5 wherein the laser apparatus 101 of Fig. 4 is assembled the laser diode 102 emits laser light into the laser beam 111. A part of the laser light is reflected from the prism system 108 to the photo diode 107 adjacent the laser diode 102. The rest of the laser light is passing the optical isolator to the light wave guide cable 110. During passing the polarised laser light is rotated. Any light reflected from the surface to be treated will be further rotated by the prism system 108, whereby no light reflected from the surface will reach the photo diode 107 in the laser diode 102.

The guide light emitted from a diode arranged paralleled with the laser diode is directed into the beam path 111 of the laser light.

15 In fig. 6 a laser diode package 15 comprising a laser diode 2 and a photo diode 7. The package 15 is covered by a glass cover 17. Laser light emitted from a laser crystal 16 through the glass cover 17 forming the laser beam 11. Furthermore, light from the laser crystal 16 emits light in the other direction, which light may be absorbed by the photo diode 7, situated behind the laser diode 2. This laser package 15 is suitable for use in any laser apparatus according to the invention wherein any light reflected from the surface to be treated is directed away from the beam paste of the laser diode, such as by the use of a optical isolator.

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Rønvig et al.
Our ref: P 364 PC00

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Amended claims 23 October 2001:

1. A laser apparatus (1, 101) for use in treatment of skin or mucosa of an animal, including a human being, comprising
 - 5 a laser light emitting optical system for emitting laser light to a surface, said surface being skin or mucosa, the laser light emitting system comprising a laser diode (2, 102) emitting a laser beam and a collimating lens (3, 103), said collimating lens (3, 103) being arranged in the laser light beam path,
 - 10 a power stabilising system for stabilising the laser light power within a predetermined power interval,
 - 15 a light wave guide cable (10, 110) arranged in the laser light beam path for directing laser light to the surface, and
 - 20 a deflection system (8, 108) for deflecting light reflected from the surface away from the power stabilising system.
2. The apparatus according to claim 1, wherein the laser light emitting optical system comprises a laser diode (2, 102) emitting light within 600 – 1000 nm.
3. The apparatus according to any of the preceding claims, wherein the laser light emitting optical system comprises a diaphragm (4, 104) with an aperture located
 - 25 between the laser light emitter and the collimating lens (3, 103) in the beam path.
4. The apparatus according to any of the preceding claims, wherein the power stabilising system comprises absorbing means (7, 107) for absorbing light emitted
 - 30 from the laser light emitting system.
5. The apparatus according to claim 4, wherein the absorbing means (7, 107) is a photo diode, preferably a silicon photo diode.

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6. The apparatus according to any of the preceding claims, wherein the deflection system comprises a transmission/reflection mirror (8) provided obliquely to the optical axis.
- 5 7. The apparatus according to claim 6, wherein at least 90 % of the light emitted is transmitted through the mirror (8).
8. The apparatus according to claim 6 or 7, wherein at most 5 % of the light is reflected, preferably at most 2 % is reflected.
- 10 9. The apparatus according to any of the preceding claims 1-5, wherein the deflection system comprises an optical isolator (108).
- 15 10. The apparatus according to claim 9, wherein the optical isolator (108) is a couple prism system with phase retarder.
11. The apparatus according to any of the preceding claims, further comprising a guide light (14, 114) emitting optical system for emitting light to the surface to be treated.
- 20 12. The apparatus according to claim 11, wherein the wave length of the guide light is lower than the wave length of the laser light emitting system.
13. The apparatus according to claim 11 or 12, wherein the transmission/reflection mirror (8) or the optical isolator (108) is arranged for directing the guide light.
- 25 14. The apparatus according to any of the preceding claims, wherein the power stabilising system and the deflection system (8, 108) is arranged adjacent in a housing (6, 106).
- 30 15. The apparatus according to claim 14, wherein the housing (6, 106) further comprises a guide light emitting optical system.
- 35 16. The apparatus according to claim 1, wherein the light wave guide cable is a quartz glass rod.

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17. A method for treating an animal, including a human being, for a laser light treat-
able disease comprising arranging a laser apparatus as defined in any of the
claims 1-16 in contact with the skin or the mucosa of the animal and allowing la-
ser light to be emitted from the laser light emitting optical system to the skin or
mucosa.

5

18. The method according to claim 17, for treating muscle damages.

10 19. The method according to claim 17, for treating ulcers.

20. Use of a laser apparatus as defined in any of the claim 1-16 for reducing the risk
that reflections reflected from a surface, whereto laser light is emitted, are capa-
ble of reaching a stabilising system of the laser light emitting system.

15

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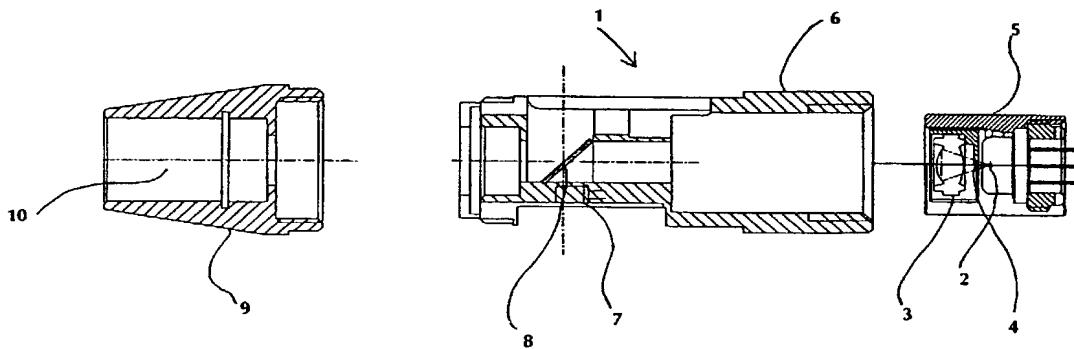
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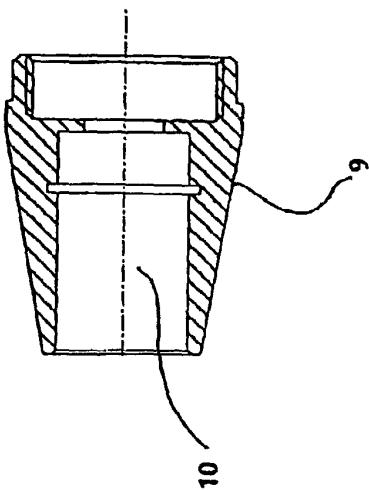
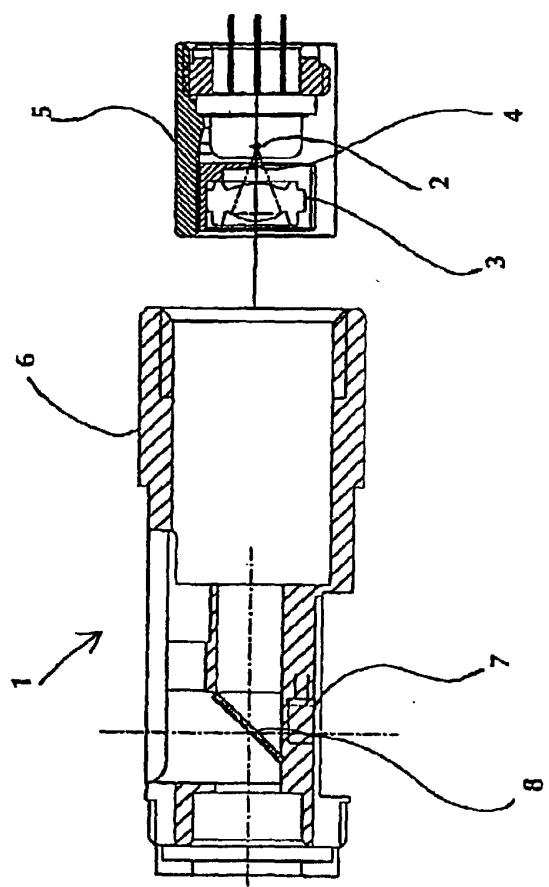
(54) Title: LASER APPARATUS WITH POWER STABILISING AND DEFLECTION SYSTEM



WO 01/19454 A3

(57) Abstract: The present relation relates to a laser apparatus comprising a laser light emitting optical system for emitting laser light to a surface, a power stabilising system for stabilising the laser light power within a predetermined power interval, and a deflection system for deflecting light reflected from the surface away from the power stabilising system. Thereby, the power stabilizing system will not erroneously regulate the power due to reflections from the surface to be treated. Furthermore, the invention relates to a method for treating an animal, including a human being, for a laser light treatable disease using the laser apparatus on the skin or the mucosa of the animal and allowing laser light to be emitted from the laser light emitting optical system to the skin or mucosa.

Fig. 1



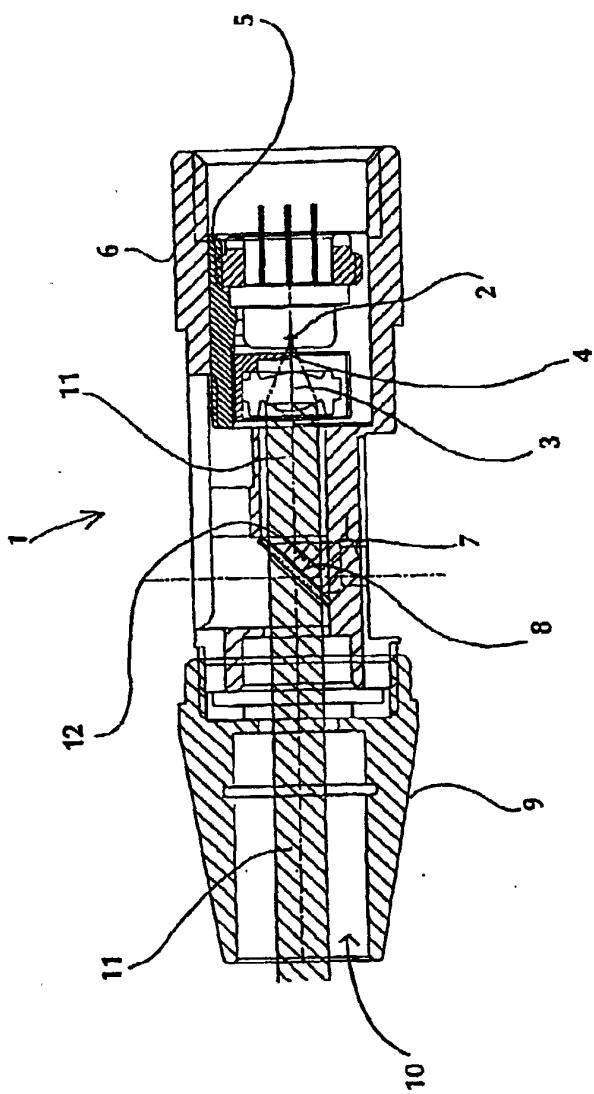


Fig. 2

Fig. 3

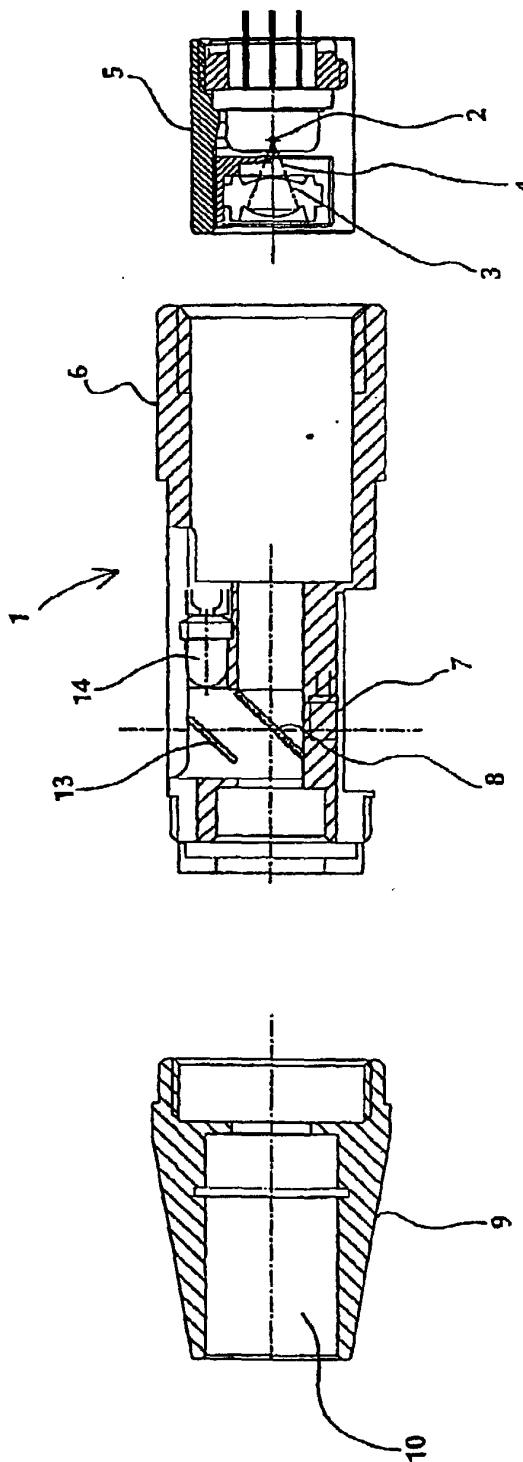


Fig. 4

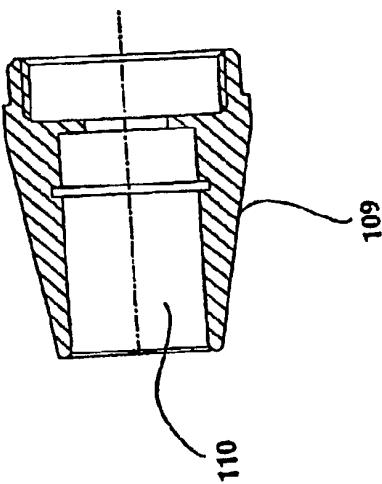
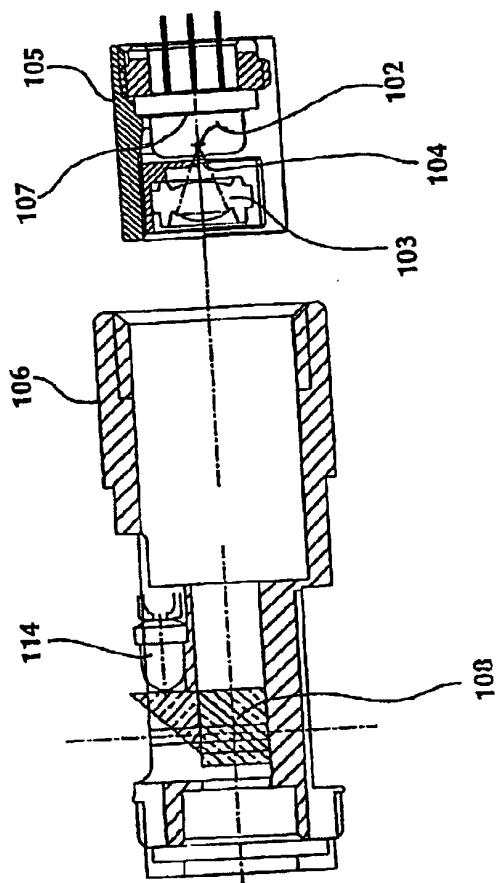


Fig. 5

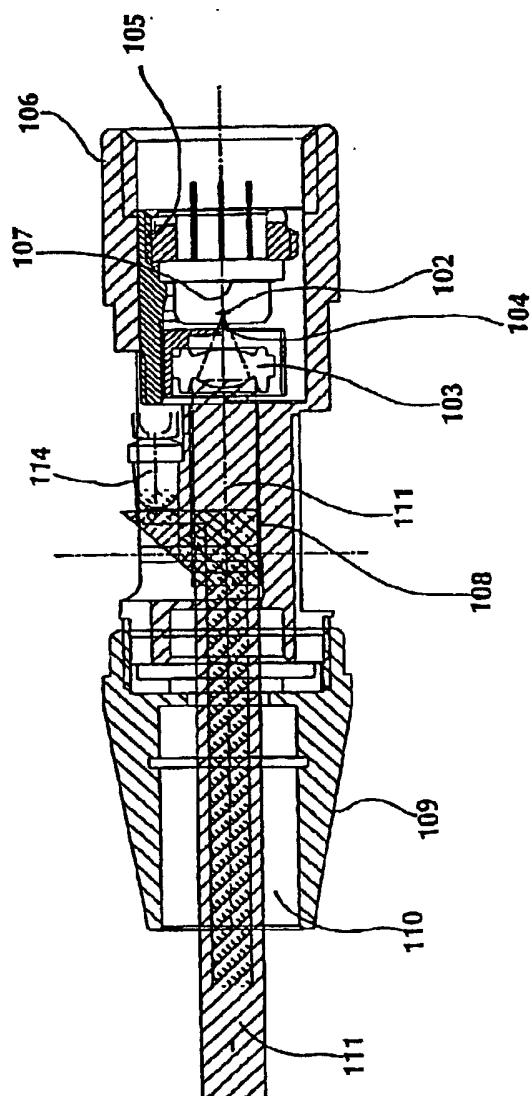
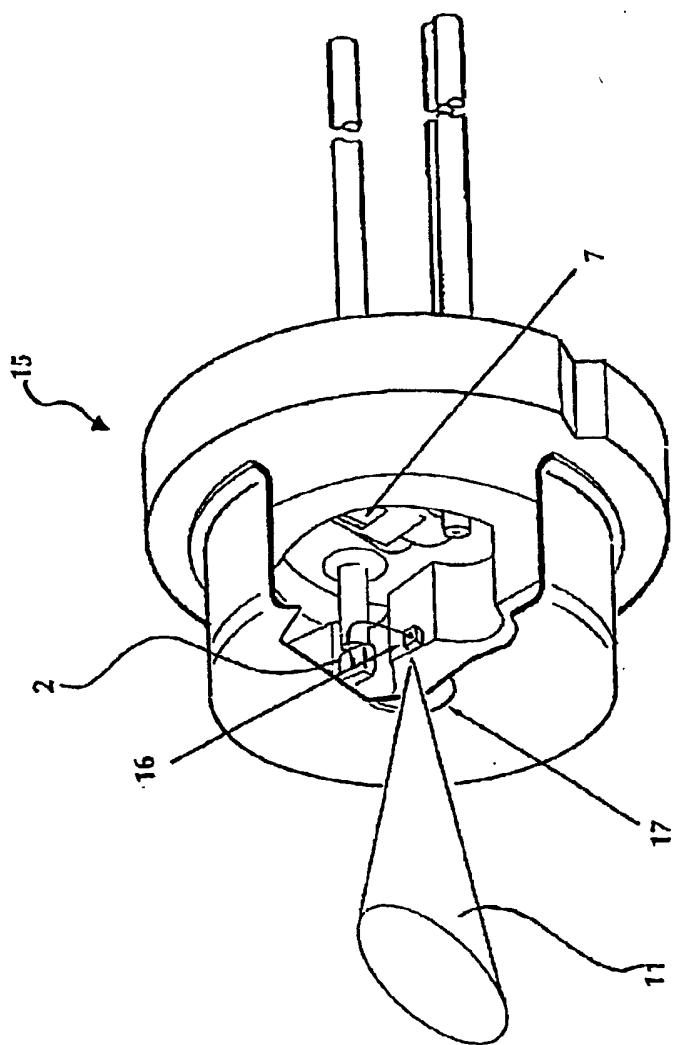


Fig. 6



Attorney Docket No. 12845.5USWO

MERCHANT & GOULD P.C.

United States Patent Application

COMBINED DECLARATION AND POWER OF ATTORNEY

As a below named inventor I hereby declare that: my residence, post office address and citizenship are as stated below next to my name; that

I verily believe I am the original, first and sole inventor (if only one name is listed below) or a joint inventor (if plural inventors are named below) of the subject matter which is claimed and for which a patent is sought on the invention entitled: LASER APPARATUS

The specification of which

a. is attached hereto
 b. was filed on 15 March 2002 as application serial no. and was amended on (if applicable) (in the case of a PCT-filed application) described and claimed in international no. PCT/DK00/00515 filed 15 September 2000 and as amended on (if any), which I have reviewed and for which I solicit a United States patent.

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I hereby claim foreign priority benefits under Title 35, United States Code, § 119/365 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on the basis of which priority is claimed:

a. no such applications have been filed.
 b. such applications have been filed as follows:

FOREIGN APPLICATION(S), IF ANY, CLAIMING PRIORITY UNDER 35 USC § 119			
COUNTRY	APPLICATION NUMBER	DATE OF FILING (day, month, year)	DATE OF ISSUE (day, month, year)
Denmark	PA 1999 01316	15 September 1999	
ALL FOREIGN APPLICATION(S), IF ANY, FILED BEFORE THE PRIORITY APPLICATION(S)			
COUNTRY	APPLICATION NUMBER	DATE OF FILING (day, month, year)	DATE OF ISSUE (day, month, year)

I hereby claim the benefit under Title 35, United States Code, § 120/365 of any United States and PCT international application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, § 112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, § 1.56(a) which occurred between the filing date of the prior application and the national or PCT international filing date of this application.

U.S. APPLICATION NUMBER	DATE OF FILING (day, month, year)	STATUS (patented, pending, abandoned)

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I acknowledge the duty to disclose information that is material to the patentability of this application in accordance with Title 37, Code of Federal Regulations, § 1.56 (reprinted below):

§ 1.56 Duty to disclose information material to patentability.

(a) A patent by its very nature is affected with a public interest. The public interest is best served, and the most effective patent examination occurs when, at the time an application is being examined, the Office is aware of and evaluates the teachings of all information material to patentability. Each individual associated with the filing and prosecution of a patent application has a duty of candor and good faith in dealing with the Office, which includes a duty to disclose to the Office all information known to that individual to be material to patentability as defined in this section. The duty to disclose information exists with respect to each pending claim until the claim is canceled or withdrawn from consideration, or the application becomes abandoned. Information material to the patentability of a claim that is canceled or withdrawn from consideration need not be submitted if the information is not material to the patentability of any claim remaining under consideration in the application. There is no duty to submit information which is not material to the patentability of any existing claim. The duty to disclose all information known to be material to patentability is deemed to be satisfied if all information known to be material to patentability of any claim issued in a patent was cited by the Office or submitted to the Office in the manner prescribed by §§ 1.97(b)-(d) and 1.98. However, no patent will be granted on an application in connection with which fraud on the Office was practiced or attempted or the duty of disclosure was violated through bad faith or intentional misconduct. The Office encourages applicants to carefully examine:

(1) prior art cited in search reports of a foreign patent office in a counterpart application, and
(2) the closest information over which individuals associated with the filing or prosecution of a patent application in claim patentably defines, to make sure that any material information contained therein is disclosed to the Office.

(b) Under this section, information is material to patentability when it is not cumulative to information already of record or being made of record in the application, and

(b) Under this section, information is material to patentability when it is not cumulative to information already of record or being made of record in the application, and

- (1) It establishes, by itself or in combination with other information, a *prima facie* case of unpatentability of a claim
- (2) It refutes, or is inconsistent with, a position the applicant takes in:
 - (i) Opposing an argument of unpatentability relied on by the Office, or
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A *prima facie* case of unpatentability is established when the information compels a conclusion that a claim is unpatentable under the preponderance of evidence, burden-of-proof standard, giving each term in the claim its broadest reasonable construction consistent with the specification, and before any consideration is given to evidence which may be submitted in an attempt to establish a contrary conclusion of patentability.

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- (3) Every other person who is substantively involved in the preparation or prosecution of the application and who is associated with the inventor, with the assignee or with anyone to whom there is an obligation to assign the application.

(d) Individuals other than the attorney, agent or inventor may comply with this section by disclosing information to the Office, agent, or inventor.

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Gregson, Richard	Reg. No. <u>41,804</u>	Tellekson, David K.	Reg. No. <u>32,314</u>
Gresens, John J.	Reg. No. <u>33,112</u>	Trembath, Jon R.	Reg. No. <u>38,344</u>
Hamer, Samuel A.	Reg. No. <u>46,754</u>	Tunheim, Marcia A.	Reg. No. <u>42,189</u>
Hamre, Curtis B.	Reg. No. <u>29,165</u>	Underhill, Albert L.	Reg. No. <u>27,403</u>
Harrison, Kevin C.	Reg. No. <u>46,759</u>	Vandenburgh, J. Derek	Reg. No. <u>32,179</u>
Hennings, Mark	Reg. No. <u>48,982</u>	Wahl, John R.	Reg. No. <u>33,044</u>
Hertzberg, Brett A.	Reg. No. <u>42,660</u>	Weaver, Paul L.	Reg. No. <u>48,640</u>
Hillson, Randall A.	Reg. No. <u>31,838</u>	Welter, Paul A.	Reg. No. <u>20,890</u>
Holzer, Jr., Richard J.	Reg. No. <u>42,668</u>	Whipps, Brian	Reg. No. <u>43,261</u>
Hope, Leonard J.	Reg. No. <u>44,774</u>	Whitaker, John E.	Reg. No. <u>42,222</u>
Jardine, John S.	Reg. No. <u>48,835</u>	Wier, David D.	Reg. No. <u>48,229</u>
Johns, Nicholas P.	Reg. No. <u>48,995</u>	Williams, Douglas J.	Reg. No. <u>27,054</u>
Johnston, Scott W.	Reg. No. <u>39,721</u>	Withers, James D.	Reg. No. <u>40,376</u>
Kadievitch, Natalie D.	Reg. No. <u>34,196</u>	Wong, Bryan A.	Reg. No. <u>50,836</u>
Kalinsky, Robert A.	Reg. No. <u>50,471</u>	Wong, Thomas S.	Reg. No. <u>48,577</u>
Kettelberger, Denise	Reg. No. <u>33,924</u>	Young, Thomas	Reg. No. <u>25,796</u>
Keys, Jeramie J.	Reg. No. <u>42,724</u>	Zeuli, Anthony R.	Reg. No. <u>45,255</u>
Knearl, Homer L.	Reg. No. <u>21,197</u>		
Kowalchyk, Alan W.	Reg. No. <u>31,535</u>		
Kowalchyk, Katherine M.	Reg. No. <u>36,848</u>		
Lamberty, Michael	Reg. No. <u>P-50,760</u>		
Lacy, Paul E.	Reg. No. <u>38,946</u>		
Larson, James A.	Reg. No. <u>40,443</u>		

I hereby authorize them to act and rely on instructions from and communicate directly with the person/assignee/attorney/firm/ organization who/which first sends/sent this case to them and by whom/which I hereby declare that I have consented after full disclosure to be represented unless/until I instruct Merchant & Gould P.C. to the contrary.

I understand that the execution of this document, and the grant of a power of attorney, does not in itself establish an attorney-client relationship between the undersigned and the law firm Merchant & Gould P.C., or any of its attorneys.

Please direct all correspondence in this case to Merchant & Gould P.C. at the address indicated below:

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P.O. Box 2903
Minneapolis, MN 55402-0903



I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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Signature of Inventor 201:

Date: 04.07.2002

2	Full Name Of Inventor	Family Name <u>VONSILD</u>	First Given Name <u>Kai</u>	Second Given Name Glud <u>04-c</u>
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Signature of Inventor 202:

Date: 2002/04/07